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*XIX. Description of an improved Apparatus for performing Electrical Experiments, in which the Electrical Power is increased, the Operator intirely secured from receiving any accidental Shocks, and the whole rendered more convenient for Experiments than heretofore : By C. L'Epinafle, F.R.S.*

Read March 12, 1767. I. **T**HE first method of improvement consists in lining the inside of the glais cylinder or globe with the following composition.

Take 4 lb of Venice turpentine, 1 lb of resin, 1 lb of bee's wax; boil these over a gentle fire, stirring them now and then, for about four hours, at the end of which, stirr in a quarter of a pound of vermilion : then, a little of the mixture being taken out and left to cool, will be hard and brittle; a token that it is fit for use. Having well heated your globe or cylinder, pour the melted mixture into it; turn the cylinder about so as to spread it evenly over the inside surface to the thickness of a sixpence, and let it cool very gradually.

The advantages that result from this are as follow.  
1st, Upon repeated trials I have constantly found, that a cylinder thus lined acted with much greater force

force than it did before it was lined, every other circumstance alike. When first I made this observation, it induced me to try what effect the lining would have upon some cylinders, which I had found so bad that I had laid them aside as useless.

Upon being lined, they proved much better than any I ever had of the same size before.

2dly, Electrical machines, when laid by for any considerable time, are very apt to be out of order, and sometimes require much trouble before they can be brought to act: this inconvenience is in a great measure removed by thus lining the glass.

3dly, The cylinders thus lined are by far less liable to break by any alteration of weather, or in working the machine, which often was the case with mine before I lined them.

4thly, As a small cylinder thus prepared is equal in power to one much larger, that is not, and requires less friction, the apparatus in which it is mounted may be much contracted, and the whole, together with the person that turns the machine, may be easily supported upon one or two small stools with glass feet, when experiments require it. With a lined cylinder  $7\frac{1}{2}$  inches in diameter, and, about 9 inches long, I have loaded three jars, that held four gallons each, to that degree as to burst one of them, which made an explosion near to that of a pocket pistol. The cylinder was mounted in a brass frame with a wheel and pinion; the wheel was turned with ease by a small brass winch, and the rotation of the winch to that of the cylinder was as one to three.

II. As raising the greatest quantity of electrical fire was the object of the first improvement, the next

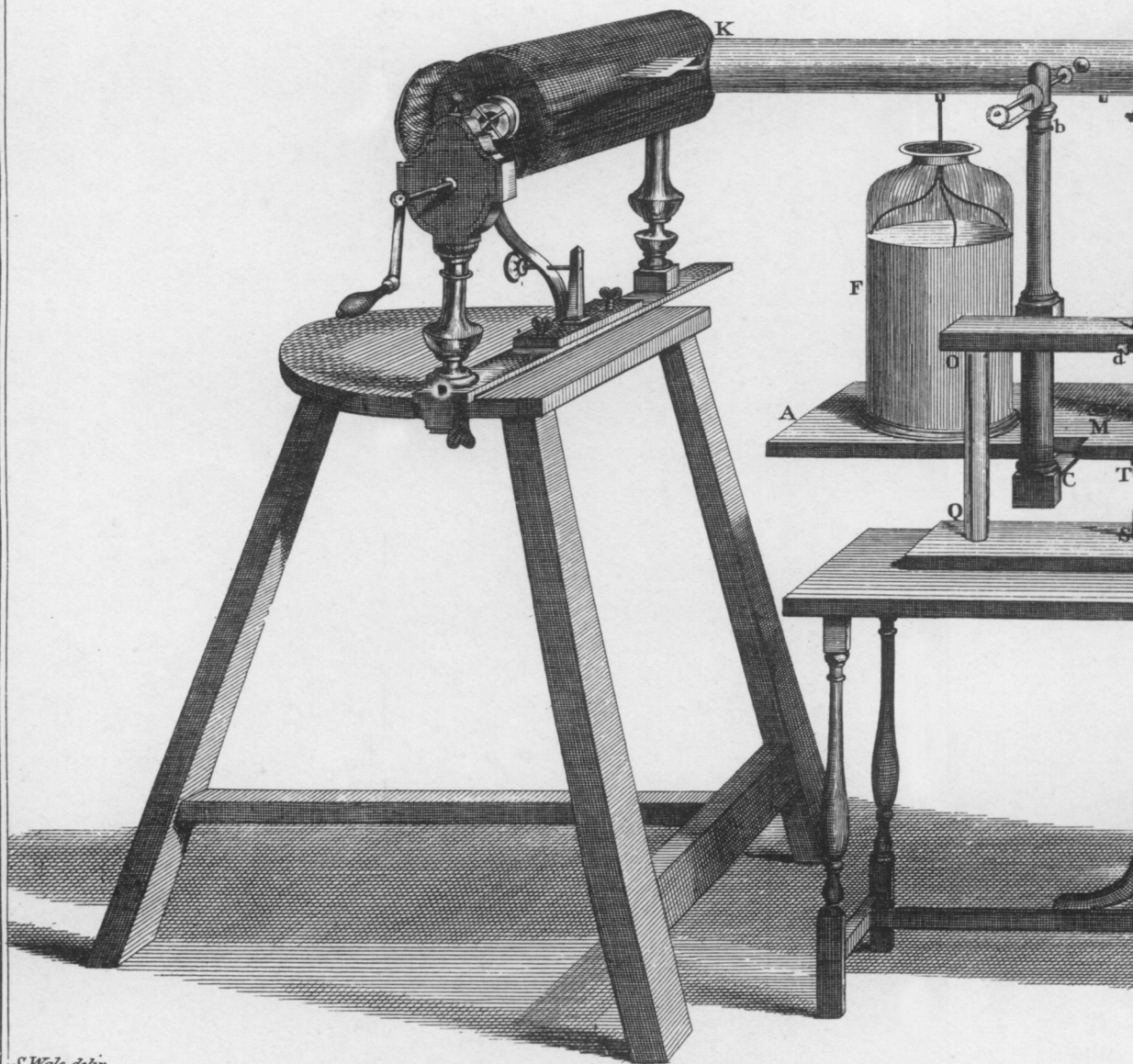
thing was, to preserve it when raised, and use it without wasting any, so that it might have its full effect. I had observed, that whenever a single wire was made use of instead of a chain in discharging the jars, the effect was much stronger; and upon making further experiments, I found that when the discharging parts were not all in close contact, such as being screwed tight together, or ground into one another, the effect was considerably diminished. In constructing the discharging apparatus, I therefore contrived that all the parts should be in close contact, by screwing grinding, or foldering, them together; and thus the electrical fire exerts its whole force on the body upon which the experiment is made.

III. Lastly, it often happened in discharging the jars when loaded very high (as they must be to kill a large animal, or to force the fire through bodies that make a great resistance), that the persons operating, notwithstanding all their skill and care, received the whole or part of the shock. This has deterred many from repeating several useful experiments, and has intimidated others that attempted to repeat them so as to make them fail of their effect. To remove this inconvenience intirely, the discharging frame is contrived, which, at the same time that it prevents the wasting of the electrical fire, leaves no possibility of the operator's ever receiving any shock. This will plainly appear upon inspecting the figure annexed.

#### EXPLANATION of TAB. XI.

AB, a mahogany board  $4\frac{1}{2}$  feet long, which supports the jars F, G, H, and the conductor KL.

This





This board has three large holes cut through it, to fit the three jars: over these holes, on the under side of the board, are nailed three tin plates, which communicate to one another by a slip of tin, and upon which the bottom of the jars rest. Under the middle of this board is also fixed by a wooden screw a cylindrical piece of wood *c*, which moves up and down in the hollow of the clawed pillar *D*, and may be stoppt at any height by means of the screw *E*; so that the whole apparatus can be raised to a height suitable to any electrical machine to which it is applied.

*F*, *G*, *H*, three glass jars, about ten inches diameter, and fourteen inches high, lined inside and out with tin foil to about two thirds of their height. A piece of wood is cemented at their top, through which there passes a thick brass wire, one end of which fits into a socket soldered to the conductor, and to the other end within the jar are fixed small wires, which spread and form a communication between the inside lining of the jars and the conductor.

*KL*, the conductor, a tin tube about five feet long and three inches in diameter, closed and rounded off at each end. At the end next the machine is fixt a piece of brass made of pointed wires in the shape of a comb, which collects the electrical fire from the machine; at the other end is fixt a slight piece of mahogany, at the end of which two small cork balls are suspended by fine threads, which balls by receding from each other, shew to what degree the power is raised; and when the jars are fully condensed will stand nearly upright as in the figure.

When experiments require to draw a spark from the conductor without a shock, which we may call  
single

single sparks, the jars are then removed, and the conductor is supported by two glass pillars, such as are used in the discharging apparatus; one end of which fits into holes made in the board at M and N, and the other end having a wire fixed to it, supports the conductor.

OPQR, the discharging frame placed on a table, and consisting of the following pieces.

QSR, a mahogany board twenty inches long and seven broad: about the middle of this board a narrow brass plate is let into the thickness of the wood, reaching from S to *a*. At the extremity *a*, which projects out of the board, there is a loop into which the end of the bent wire Z is fitted by being ground into it, the other extremity receives the end of the nut S.

S, a brass nut made with a double screw, the lower end being a male screw, to fasten it to the brass plate; and the upper end a female screw, to receive the ends of different wires and other pieces which fit into it for performing various experiments.

OQ, PR, two glass pillars about twelve inches long and an inch thick, made with shoulders at the end, which fit into the board QR, and the rail OP.

OP, a mahogany rail three inches broad and  $1\frac{1}{4}$  thick, nearly the same length with the board QR, which receives the upper ends of the glass pillars.

TV, a thick brass wire, which passes through the middle of the rail, and, by means of a screw at *d*, may be stopped at any height. At the upper end V of this wire is a loop, and at the lower end T a screw, to which pieces are fixed to answer those in the nut S.

W, a solid piece of brass, through which the upright wire TV passes, which may be shifted to any  
part



part of this wire suitable to the height of the conductor, and fixt there by a screw. A cross wire WX is fixt to this piece with a moveable joint towards W, so that it may be drawn up or let down by the silk string Y; one end of which is fixt to the cross wire, and the other end passes through the loop V.

X, a small brass knob at the end of the wire.

Z, a bent wire, which forms the communication between the discharging frame and the outside coating of the jars; one end of this wire is ground into a brass loop at *a*, and the other into a loop of the same kind at *e*, which is soldered to the tin plate that lies under the jars.

*bC*, an electrometer, which may be fixt on occasionally. When the discharging frame is used, the body upon which the experiment is made is placed between the nut S, and the end T of the upright wire, which is brought into contact with it; then the wire WX is drawn up to an erect position; and, after the jars are sufficiently loaded, it is let down upon the conductor by the silk string Y, and discharging the jars, the electrical spark in forming the circle passes through the body. Care must be taken to keep the glass pillars dry and clean, that none of the fire be wasted.

When an animal is to be killed, he must be fastened to a board, and his head placed between the two points S, and T. If the discharging frame be removed, the apparatus may be used in medical cases as usual; either with an electrometer or without.